

WHAT IS CLAIMED IS:

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1. A wafer polishing machine for the chemical mechanical planarization of a surface of a semiconductor wafer with an abrasive polishing agent comprising:
a wafer support assembly having a wafer holder shaped to receive said wafer and support said wafer with said surface projecting from said wafer holder;
a linear polishing assembly having a polishing member positioned to engage said surface of said wafer, said polishing member being movable in a linear direction relative to said wafer to continuously apply a uniform polishing force across said surface of said wafer during operation of said wafer polishing machine for uniformly polishing said surface of said wafer.
 2. The wafer polishing machine of Claim 1 in which said polishing member comprises a belt and a polishing material mounted to said belt.
 3. The wafer polishing machine of Claim 2 in which said belt is movable in a continuous path, and further comprising a conditioning station positioned in said path of said belt for conditioning said polishing material during operation of said wafer polishing machine.
 4. The wafer polishing machine of Claim 1 in which said polishing member comprises a plurality of reciprocating bars having a polishing material mounted to said bars, said bars being movable in a linear direction relative to said wafer.
 5. The wafer polishing machine of Claim 4 in which said polishing assembly includes at least one actuating device coupled to said bars for moving said bars in a linear direction relative to said wafer.
 6. The wafer polishing machine of Claim 5 in which said polishing assembly includes a control system coupled to said actuating device, which control system is configured for moving said bars in accordance with a selected velocity profile.

7. The wafer polishing machine of Claim 1 in which said polishing member is movable at a constant, linear velocity relative to said wafer to continuously apply said uniform polishing force across said surface of said wafer.

8. The wafer polishing machine of Claim 1 in which said wafer holder is rotatable relative to said polishing member at a rate of at most approximately 1/10 of the velocity of said polishing member, said polishing member being moved in said linear direction relative to said wafer so that when said wafer holder is rotated, the angular velocity of said wafer relative to said polishing member is uniform across said surface of said wafer.

9. The wafer polishing machine of Claim 1 in which said polishing member is impregnated with said abrasive polishing agent.

10. The wafer polishing machine of Claim 1 in which one of said support assembly and said polishing assembly includes a pivotal alignment device positioned to pivotally support one of said wafer holder and said polishing member relative to the other of said wafer holder and said polishing member with said surface of said wafer and said polishing member retained in parallel alignment during operation of said wafer polishing machine.

11. The wafer polishing machine of Claim 10 in which said alignment device is coupled to said wafer holder, said alignment device supporting said wafer holder and orienting said wafer holder to position said surface of said wafer parallel to said polishing member during operation of said wafer polishing machine.

12. The wafer polishing machine of Claim 10 in which said alignment device supports said polishing member and orients said polishing member parallel to said surface of said wafer during operation of said wafer polishing machine.

13. The wafer polishing machine of Claim 10 in which said alignment device includes a journal supported in a bearing, said journal being pivotal relative to said bearing about a pivot point located on said surface of said wafer.

14. The wafer polishing machine of Claim 13 in which said journal is formed in the shape of a section of a sphere and in which said pivot point is located at the center of said sphere.
15. The wafer polishing machine of Claim 13 in which said journal and said bearing are separated by a lubricant.
16. A method for uniformly planarizing the surface of a semiconductor wafer using a polisher having a movable polishing member comprising the steps of:
 - supporting said wafer with said surface of said wafer engaging said polishing member; and
 - moving said polishing member in a linear direction relative to said wafer to apply a uniform polishing force across said surface of said wafer to uniformly planarize said surface of said wafer.
17. The method of Claim 16 in which said moving step includes moving said polishing member at a constant velocity within the range of 50 to 150 feet per minute.
18. The method of Claim 16 in which said moving step includes moving said polishing member in accordance with a velocity profile selected to apply a uniform polishing force across said surface of said wafer.
19. The method of Claim 16, and further comprising the step of rotating said wafer relative to said polishing member.
20. The method of Claim 19 in which said step of rotating said wafer includes rotating said wafer at a velocity of at most approximately $1/10$ the velocity of said polishing member, with the angular velocity of said wafer relative to said polishing member being uniform across said surface of said wafer.

21. The method of Claim 16 in which said moving step includes moving said polishing member in a continuous path in which said polishing member passes across said surface of said wafer, and further comprising the step of conditioning said polishing member as said polishing member travels in said continuous path.

22. The method of claim 16 which further comprises the step of pivoting one of said wafer and said polishing member relative to the other of said wafer and said polishing member until said surface of said wafer and said polishing member are substantially parallel.

23. A wafer polishing machine for planarizing a surface of a semiconductor wafer comprising:

a wafer holder shaped to receive said wafer and support said wafer with said surface of said wafer projecting from said wafer holder;

a polishing assembly associated with said wafer holder having a polishing member movable in a continuous path in which said polishing member engages and moves across said surface of said wafer in a linear direction relative to said wafer; and

a conditioning station positioned in said path of said polishing member downstream from said support assembly for conditioning said polishing member during operation of said polishing machine.

24. The wafer polishing machine of Claim 23 in which said polishing member comprises an endless belt and a polishing pad mounted to said endless belt.

25. The wafer polishing machine of Claim 23 in which said conditioning station includes a scraping element positioned to engage said polishing member downstream of said wafer holder.

26. The wafer polishing machine of Claim 23 in which said conditioning station includes at least one bath for submersing said polishing member in one of an acidic solution, a rinsing solution and a polishing agent solution.

27. The wafer polishing machine of Claim 23 in which said conditioning station includes at least one acid bath, at least one rinse bath and at least one polishing agent bath positioned in said path of said polishing member.

28. The wafer polishing machine of Claim 23 in which said conditioning station includes at least one injection nozzle for spraying said polishing member with one of an acidic solution, a rinsing solution and a polishing agent solution.

29. The wafer polishing machine of Claim 23, and further comprising a pivotal alignment device associated with one of said wafer holder and said polishing assembly, said alignment device being positioned to pivotally support one of said wafer holder and said polishing member with said surface of said wafer and said polishing member retained in parallel alignment during operation of said wafer polishing machine.

30. A wafer support assembly for supporting a semiconductor wafer for polishing a surface of said wafer comprising:

a journal member having a planar support surface for supporting said wafer, said journal member being formed in the shape of a section of a sphere in which said planar support surface is separated from the center of said sphere by a distance approximately equal to said thickness of said wafer such that when said journal member supports said wafer, said center of said sphere is located on said wafer surface; and

a bearing mountable to a support platform having a recessed region shaped to receive said journal member, said journal being pivotal within said recessed region relative to said bearing about said center of said sphere.

31. The wafer polishing machine of Claim 30 in which said journal and said bearing are separated by a lubricant.

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